Wanting a Bit(e) of Everything. The Role of Hunger in Variety Seeking.

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We examined whether consumers seek more or less variety when shopping on an empty stomach. The data show that hunger increases variety seeking when consumers make multiple food choices at once. In a first study, participants in the hungry condition selected a more varied flavor set than satiated participants. Food attractiveness mediated the hunger effect. In study 2, we manipulated food attractiveness by the presence of stale food. In study 3, we increased variety seeking by introducing an appetizing olfactory cue. Our findings provide theoretical insights on choice rules and suggest guidelines on the management of variety seeking.

Most people prefer some variety in their choices of activities, snacks, music, clothes, restaurants… In this article, we examine the effect of hunger on the tendency of individuals to seek diversity in their choices of foods. We focus on the common situation when consumers shop for an entire week's groceries in one trip. They will have to predict in advance, at the point of purchase, which products they will like and, consequently, how much variety they will enjoy during the coming week. Such 'affective' forecasting is known to be difficult, even under optimal conditions (Kahneman and Snell 1992). A non neutral visceral state, such as hunger, renders it even harder to make correct predictions (Loewenstein, O'Donoghue, and Rabin 2003). Whether hunger facilitates or inhibits variety seeking is not immediately obvious. Both directional effects are theoretically possible as we explain more fully below. In a first study, we show that hunger actually increases variety seeking in products that will be consumed in the near future. The effect is mediated by a hunger-induced increase in food attractiveness. We also found that hunger has an influence on how choices are made: hunger makes consumers choose more in proportion to their food ratings. Two follow-up studies confirm the crucial role of food attractiveness. We manipulated food attractiveness by another means than hunger: in the second study we used stale food; in the third study an olfactory food cue was used.

AFFECTIVE FORECASTING

Affective forecasting, namely people's predictions about their future feelings or tastes, has received a lot of interest in recent years (e.g. Gilbert, Gill, and Wilson 2002; Loewenstein et al. 2003; Pham 1998; Read and van Leeuwen 1998). One reason is that many everyday decisions are based on affective forecasts. These decisions require that people make reasonable predictions in the present about what they will enjoy in the future.

But how good are we at it? Kahneman and Snell (1992) came to the conclusion that people have difficulty predicting their own tastes and preferences. The easiest way to do this is to take into account one's current desires as a baseline and then to adjust them according to anticipated changes in circumstances (Gilbert et al. 2002). Several articles report that the current hedonic response provides a powerful anchor in predicting future tastes in the relative short term (Kahneman and Snell 1992; Read and van Leeuwen 1998). At any moment our tastes are the result of a unique constellation of needs and desires. Typically, however, we adjust insufficiently: We do not take sufficiently into account how much our tastes change over time (Kahneman and Snell 1992). These changes can reflect a change in hedonic tastes,

changing needs, or changing personal goals (e.g. going on a diet). However, we persist in weighing our current tastes heavily when predicting what we will want, even though we are poor or useless guides to future tastes (Loewenstein 1996).

VISCERAL STATES

One problem in predicting our future tastes (Loewenstein 1996) is that they vary due to fluctuations in "visceral states", which include hunger, thirst, arousal, sleepiness, moods, and emotions. These visceral states are unstable and prone to radical changes in the course of a few hours or even minutes, yet they can have profound effects on our desires. For predicting *future* tastes our *current* visceral state is an important factor. Loewenstein et al. (2003) argue that anchoring occurs because it is inordinately difficult for us to imagine what it is like to be in a different visceral state than the one we are currently in. That is, when people are in a "cold", neutral, state, they have difficulty imagining how they would feel or what they might want if they are in a "hot" state, like anger, hunger, pain, or sexual excitement, and vice versa. According to Loewenstein (1996), our ability to bring to mind drives and emotions is highly constrained: memory for visceral states seems to correspond to remembering the circumstances under which the feeling was experienced, but failing to remember the feeling itself. For example, pregnant women may eschew anesthesia because the pain of childbirth does not seem real to them until they actually (re-)experience it; the recovering alcoholic overestimates the chances of safely attending the office Christmas party; and people who are not in a shopping situation underestimate the "urge to splurge" (Hoch and Loewenstein 1991) that they will experience when entering the shopping mall. We underappreciate what a hot state will feel like in the future and how such a state will affect our behavior (Loewenstein and Agner 2003).

Prior research has already examined the effect of a few visceral states on variety seeking. Research on the impact of arousal on decision-making (e.g. Menon and Kahn 2002; Sanbonmatsu and Kardes 1988) has typically found that higher arousal levels lead to low levels of exploratory behavior. This is because more arousing stimuli demand more attention and cognitive resources (Cohen 1978), and consumers will try to conserve cognitive resources for subsequent tasks. For example, in crowded stores, customers engage less in exploratory shopping (Harrell, Hutt, and Anderson 1980). Induced pleasure has been found to encourage exploratory behavior and a desire to seek more stimulation in subsequent tasks. Kahn and Isen (1993) suggested that happy individuals show increased preference for stimulation and variety

as long as they feel safe. They suggested that this is because positive affect leads to greater elaboration and higher recognition of the differences between brands. In various experiments, Kahn and Isen (1993) and Menon and Kahn (1995) found evidence to support this conjecture by demonstrating that positive affect leads to increased variety seeking behavior and more experimentation.

Considerably less is known, however, about whether and how other visceral states have an influence on variety seeking. More specifically, in this article we focus on the effects of hunger on variety seeking during a shopping trip. It has already been shown that an individual's current hunger state has an effect on food choices that apply to the future. For example, Nisbett and Kanouse (1969) observed, for normal weight shoppers, a positive correlation between overshopping and hunger. Read and van Leeuwen (1998) concluded that advance choices were influenced by current hunger: Hungry participants chose more unhealthy snacks than did satiated people. Gilbert et al. (2002) found that listless shoppers who had not eaten for several hours bought more items for the coming week than they had originally intended, failing to adjust for the fact that they would often be satiated during the week and not experiencing the same cravings. This article further examines how hunger influences the exploratory tendencies of people. In three studies we test two opposite hypotheses.

HYPOTHESES

We propose that the overall effect of hunger on variety seeking may be driven by two processes: (1) the projection bias, which tends to increase the perceived utility of a varied choice, and (2) depletion of cognitive resources which may decrease variety seeking.

Projection bias

The projection bias is the tendency for people to underappreciate the effect of changes in their (visceral) states, and mistakenly project their current tastes onto their future tastes (Loewenstein 1996). Hunger, as a visceral state, increases one's immediate desire for food (Loewenstein and Agner 2003). This reflects the anecdotal belief that shopping with an empty stomach makes everything seem appetizing. Because this also applies to our non-favorite food items, hunger could encourage us to seek variety and/or try new things. Similarly, Tom (1983) found that food deprivation was associated with more purchases of unplanned,

displayed food items. So, we suggest that hunger adds to the perceived utility of all available choice options. Because of the poor adjustment for future changes in visceral states, this increased utility is not sufficiently corrected for when predicting future tastes. Assuming that increasing overall food attitudes reduce the relative advantage of the favorite option, hunger should facilitate variety seeking.

Depletion of cognitive resources

It is also possible that hunger, like arousal (Humphreys and Revelle 1984) demands cognitive resources and impairs working memory capacity, for instance because hunger narrows attention to food (Brendl, Markman, and Messner 2003). This would imply that hunger decreases variety seeking. Consistently, Gibbs and Drolet (2003) found that lower energy levels shift consumption choices toward less challenging products. So, when variety seeking depends on cognitive resources that are depleted in a state of hunger, the consumer is not likely to explore new things. Given the functional similarity between hunger and arousal (that is, both states increase the focus of attention on one aspect of the situation), the prediction is consistent with the dominant response theory developed by Zajonc (1965). He suggested that there is an innate tendency to perform the dominant response under increased arousal. The dominant response is the response with the greatest habit strength, the simplest response to the situation, or, in this case our traditional purchases. So, if hunger affects cognitive resources in a similar way as arousal does, we expect that hunger will decrease variety seeking.

STUDY 1

This study examines whether hunger increases or decreases variety seeking. We asked hungry versus satiated participants to choose five sandwiches from a set of eight for the coming week. Variety seeking was operationalized as the number of different sandwiches participants ordered. The primary objective was to find whether and in what direction hunger affects variety seeking. The second objective was to explore the underlying process.

Participants

Participants were 118 undergraduates (60 men, 58 women). Eighty-three students participated in exchange for extra course credit. Thirty-five students were each paid €7 for their participation. Two participants were excluded from analyses because they were not native speakers. Data from one participant were discarded because he expressed awareness of the experiment's purpose.

Design

Participants were randomly assigned to the Hungry or the Satiated condition. We manipulated the hunger state by asking all participants not to eat within 4 hours before the experiment and not to drink anything else but tea, coffee or water. To facilitate this, we organized the sessions just before local lunch time (i.e. 11:30 am and 12:30 pm.) and just before local dinner (4:30 pm. and 5:30 pm.). During the experiment all participants in the Satiated condition were offered a big piece of cake, which they had to eat completely.

Materials and procedure

The first part of our experiment took place two weeks before the actual experimental session for which all students were invited. During the first class meeting of the course, all attending students (n = 57) were asked to complete a 'catering form'. They were led to believe that the forms had been distributed by the catering service of the university. The form measured personal liking ratings for various food-items (including sandwiches) and beverages on a 5-point scale. Two weeks later, all participants (including the students who were present during the first session) came to the lab in groups of 6 to 8 under the guise of participating in a taste test. They were seated in partially enclosed cubicles to prevent interaction during the experiment. First, they completed an introductory questionnaire to check compliance with our food abstinence request. Then the participants in the Satiated condition had to eat a big piece of cake as part of a taste-test. The cake was described as a healthy, newly-developed product of a well-known sandwich bar in the area. The taste test consisted of twenty questions with reference to taste, the color, the structure, and the healthiness of the cake. As it takes about 20 min. before the sensation of abstinence fades (Guyton 1971), participants subsequently received filler tasks for about 20 min. After these filler tasks, we introduced an additional reward for participating. They were told that a well-known local sandwich bar offered the opportunity to win free sandwiches during the upcoming week. Therefore, all participants had

to indicate which sandwich (cheese, ham, crab, salmon, tuna, potato, bacon, or mozzarella) they would like on each day of the coming working week (Monday to Friday). Each participant had to make five choices. Participants were asked to put the form in a box while leaving the lab. Later, during the next class session, eight forms were drawn from this box and the names of the winners were communicated. After the choice task, we asked every participant to complete the catering rating form again. When they mentioned that they had already filled out this form, we told them that this was probably due to a mistake made by the catering service, but that they should complete it anyway.

Results

Effect of hunger on variety seeking. Variety seeking was operationalized as the number of different sandwiches participants ordered. We found that hungry participants (M_{hungry} = 4.10) chose significantly more variety than satiated participants ($M_{satiated}$ = 3.58), $F(1, 115) = 7.01$, $p < .01$). This effect did not depend on gender ($F(1, 113) = 0.63$, NS). Thus, we conclude that hunger increases variety seeking. In what follows, we examine the underlying process.

Effect of hunger on sandwich ratings. During the laboratory experiment all participants rated a set of eight sandwiches. The results of an ANOVA analysis of hunger on these ratings indicate that hungry participants (M_{hungry} = 3.46) overall rated the sandwiches higher than satiated participants ($M_{satiated}$ = 3.00) ($F(1, 114) = 15.67$, $p < .01$). To know whether this difference is due to an increase of the hungry participants' ratings or to a decrease of the satiated participants' ratings, we also performed a within-subject analysis. For half of the participants, we had measured the individual sandwich ratings twice. The first set reveals the participant's ratings in a normal visceral state (R_1), whereas the second set reveals ratings in a hungry or satiated state, depending on the experimental condition (R_2). We found that participants' overall food ratings increased more from the first to the second measurement when hungry (ΔM_{hungry} = 0.43) than when not hungry ($\Delta M_{satiated}$ = -0.02), $F(1, 54) = 12.43$, $p < .01$. We also found that the fact that there was a pre-measurement of the sandwich ratings or not did not interact with hunger on food attitudes ($F(1, 112)=0.01$, NS). Thus, answering rating questions did not influence this hunger effect. We can conclude that food attractiveness is systematically higher in a hunger state.

Still, dissonance research suggests an alternative explanation for this finding. Participants may have tended to increase their ratings for objects they had previously chosen and decrease

their ratings for objects they had rejected (Brehm 1956). Because all participants had just chosen a set of sandwiches, it is possible that they were evaluating them more positively. However, we found a similar difference for the ratings of the sandwiches that were not selected ($M_{hungry} = 2.65$, $M_{satiated} = 2.18$; $F(1, 114) = 12.69$, $p < .01$). Also, we found a similar effect of hunger on the ratings of the other food items on the catering form, and for which the participants did not make a choice ($M_{hungry} = 3.95$, $M_{satiated} = 3.59$; $F(1, 114) = 5.21$, $p = .02$). In contrast, hunger did not have an effect on the ratings of the beverages on the catering forms, $F(1, 113) = 0.76$, NS. Thus, we conclude that hunger increases food ratings. The clearest analogy to this finding comes from Lozano, Crites, and Aikman (1999) who demonstrated that food attitudes are more positive when people are hungry than when they are not hungry.

Mediation by attractiveness. Further analyses showed that the increase in food attractiveness mediated the effect of hunger on variety seeking. That is, when we include the mean of the second set of ratings R_2 as a covariate in the ANOVA analysis with variety seeking as the dependent variable and hunger as the independent variable, the *F*-statistic for hunger on variety seeking ($F(1, 115)$) is substantially reduced from 7.01 ($p < .01$) to 0.41 (NS), and there is a 49% reduction in the mean squares (*MS*)[1], while the effect of the mean ratings R_2 is significant ($F(1, 113) = 28.53$, $p < .01$). Also, a path analysis indicated that the model in which increasing food attractiveness is responsible for the hunger effect on variety seeking fits the data extremely well ($\chi^2(1) = 0.417$, $p = .52$, *RMSEA* = 0). Moreover, it fits much better than the two other possible models. First, the model where hunger has a direct effect on variety seeking, and subsequently leads to an increase in food ratings (consistent with the dissonance model and the actual order of measurement), fits much worse (*RMSEA* = 0.47). Second, the model in which there is no direct relation between the increase in food ratings and the increase in variety seeking also does not fit our data (*RMSEA* = 0.26). We conclude that the increase in variety seeking, due to hunger, is largely caused by an increase in food attractiveness.

Effect of hunger on choice processes. Hitherto, we found that hunger increased variety seeking, and we provided evidence that increasing food attractiveness mediated this effect. To gain further insight in the effect of hunger on variety seeking, we examined whether the

[1] We report the percent reduction of the MSs of the mediated effect because in ANCOVA changes of the magnitude of the experimental effect (ω^2) also reflect changes in the MS error that are unrelated to the experimental factor of interest (Pham and Muthukrishnan 2002).

choice process itself depended on the hunger state. First, it is possible that hunger makes people choose randomly between food items. However, we found that the correlation between R_1 and R_2 was consistently high ($M = 0.80$; $SD = 0.17$), and that there was no effect of hunger on the Fischer-*Z* transformed correlations ($F(1, 54) = 0.14$, $p > .20$). As people do not choose randomly between food items, they must adhere to some kind of choice rule. As hungry people opt for more variety in their choices, it is possible that hungry versus satiated people adhere to qualitatively different choice rules. To examine this, we considered two extreme choice rules. On the one hand, people can always stick to their favorites which, in theory, would lead to maximum satisfaction. We call this a dominance based-choice rule. On the other hand, however, people can sample from all options and do so in proportion to their ratings. We call this a proportion-based choice rule. This rule seems consistent with people's tendency to switch away from their favorites, just for the sake of variety (Ratner, Kahn, and Kahneman 1999). To assess the consistency to these two choice rules, we constructed an index ζ (see appendix). ζ ranges between zero and one: It equals one for individuals whose choice behavior is perfectly consistent with their sandwich ratings according to one of the two choice rules. We calculated ζ for both a dominance-based and a proportion-based choice rule. A dominance-based choice refers to a choice in which a consumer chooses only those sandwich(es) that he/she gave the highest score, while a proportion-based choice refers to a choice in which a consumer chooses sandwiches in proportion to his/her personal ratings. In the latter case, he/she does not only choose the sandwiches with the highest ratings, but also those with somewhat lower ratings. To assess to what extent the participants' choices were proportion-based, we calculated the difference between those two measures ($\zeta_{prop} - \zeta_{domin}$). After discarding two outliers (one in each condition) we found that satiated participants displayed a relatively less proportion-based choice rule than hungry participants ($M_{hungry} = 0.022$, $M_{satiated} = 0.083$; $F(1, 111) = 4.16$, $p = .04$). That is, hunger makes consumers deviate (even more) from their absolute favorites and makes them choose more in proportion to their food ratings. This corresponds to the definition of variety seeking provided by Kahn (1995).

Cognitive depletion hypothesis. It was further hypothesized that hunger might have a negative effect on cognitive resources. As a result, hunger would decrease variety seeking. As hunger facilitated variety seeking, our results did not support this hypothesis. However, our experiment might not have provided a fair test for the depletion hypothesis. When the choice set does not contain a clear favorite option, depletion of cognitive resources might encourage variety seeking rather than decreasing it. When an individual has a few appropriate

alternatives in mind and does not have the cognitive resources available or the motivation to make a thorough comparison, variety seeking might reflect the consumer's avoidance of weighing the different attributes and reflect a random choice. Indeed, decision-making under preference uncertainty has been described as involving discomfort, conflict, and even pain (Abelson and Levi 1985). Resolving this conflict and determining which of the considered options is most preferred, might require much time and cognitive effort (Simonson 1990). To simplify the task of making multiple purchases in a category, a consumer might simply select the top candidates for choice, and remove the need to determine which the most preferred option is. Under this assumption, our original hypothesis that hunger would reduce variety seeking would only apply to the situation where there is a clear favorite option. But when the choice set does not contain a clear favorite option, depletion of cognitive resources might encourage variety seeking. To test this, we created a variable 'preference certainty'. We counted how many sandwiches received a participant's highest score. A lot of ties mean that participants have no clear favorite options. We created two groups: the participants who gave only one sandwich the highest score (n = 37) versus those that gave equally high ratings to more than one sandwich (n = 79). An ANOVA analysis of the number of different choices (i.e. variety seeking) strongly suggests that preference certainty did not interact with hunger, $F(1, 112) = 0.01$, NS). Participants without a clear favorite option (i.e. low certainty) indeed chose more variety ($M_{hungry} = 4.20$) when hungry than when satiated ($M_{satiated} = 3.71$). However, people with a clear favorite choice (i.e. high certainty) showed a similar hunger effect: they choose more variety when hungry ($M_{hungry} = 3.90$ vs. $M_{satiated} = 3.37$). If hunger would deplete cognitive resources, a consumer should be less likely to explore under high certainty conditions when hungry. Hence, the results of our additional analysis do not support the cognitive resource hypothesis.

Discussion

We conclude that hunger enhances food attractiveness, which leads to an increase in variety seeking. In particular, by bringing consumers in a hunger state, we impede them from correctly predicting their future food ratings. Consumers rate food items more positively when hungry, and, because more food items satisfy their needs, they opt for a more varied choice set. Moreover, between-subject analyses revealed that satiated participants tend to use

a less proportion-based choice rule than hungry participants[2]. Overall, the findings are consistent with the projection bias hypothesis. The participants did not correct for their 'temporal' increase in food attractiveness. Although they possibly knew that their decisions were biased by their current hunger feelings, they did not correct for this sufficiently. It appears to be too difficult to imagine themselves in a different visceral state than the one they were currently in. This made them choose some sandwiches that they actually did not like too much.

In summary, the results of the first study show that hunger has a facilitating effect on variety seeking. We also found a first indication that increased food attractiveness is responsible for this effect. We acknowledge two weaknesses of our current study. The first limitation is that the interpretation of the mediating process is based on correlations. The second limitation is that the food ratings were measured after the choices. Demonstrating that variety seeking can be influenced by directly manipulating food attractiveness would reduce these concerns. This issue is addressed in study 2.

STUDY 2

With the second study, we tried to achieve two goals. First, we wanted to replicate the results of the first study for a reversed order of the tasks. Second, by explicitly manipulating food attractiveness by another means than hunger, we tried to find additional evidence for the underlying process. In the current study, we tried to manipulate sandwich attractiveness by placing a plate of sandwiches in the laboratory. Previous research (Lambert and Neal 1992) has shown that seeing a food stimulus has a positive effect on consumers' food attractiveness. Here, however, instead of using fresh sandwiches, we chose to display sandwiches that were about two days old. In a pilot study (n = 63), we found that a plate of stale sandwiches as a food cue increased the sandwich attractiveness for low disgust sensitive people, and decreased it for high disgust sensitive people. Showing stale sandwiches did not affect the hunger feelings of the participants in the pilot study. Thus, by using a plate of sandwiches in this study we had the opportunity to manipulate food attractiveness in two independent ways: by means of hunger, and by means of presence of stale sandwiches, moderated by disgust. As a result, we could examine the underlying process of hunger influencing variety seeking. We

[2] One could argue that hungry participants do not use a different choice rule but only seem to use a more proportional based choice rule because of a ceiling effect due to the increasing food ratings. However, our data do not support this reasoning: The number of times a participant gave a sandwich the highest score (= 5) is even slightly lower (but not significantly so) in the hungry (M = 1.43) condition than in the satiated (M = 1.73) condition ($F(1, 114) = 1.45$, $p = .23$).

expected the food cue to increase the exploratory tendencies of low disgust sensitive participants, while decreasing it for high disgust sensitive participants. We expected that changing food ratings would drive this effect. For the hunger manipulation, we expected the same pattern as in study 1: hunger increases food ratings, and hence variety seeking.

Participants

One hundred and twenty-four students (55 men, 69 women) at a regional university campus participated in the 60-min laboratory session, in exchange for course credit.

Design

A between-participants 2 x 2 design was used. Hunger was manipulated in the same way as in the first study. We also manipulated food attractiveness by the presence of a plate of stale sandwiches in the laboratory room. Further, we measured disgust sensitivity and included it as an independent variable in the analyses. As previous research (Haidt, McCauley, and Rozin 1993) has found a correlation between gender and disgust sensitivity, participants' gender was included as a control variable in all analyses.

Materials and procedure

The procedure closely followed that of the first study. In the laboratory, participants learned that they would be participating in a taste test. We asked them to hold a small clinistick in their mouth while filling in the introductory form (in which they answered questions pertaining to the time of their last meal). We told them that this stick, which was in fact a glucose stick, gave an indication of the time since their last meal. We did this merely to encourage participants to complete the 'last meal question' truthfully. Participants in the Satiated condition were subsequently given a piece of cake, supposedly as part of a cake taste test.

After 20 min. of filler tasks, the participants in the Presence condition were asked to come to the table at which the experimenter was sitting, under the pretext of a check of an unrelated task. On this table there was a plate with sandwiches. These sandwiches lied messily on a plate together with some dirty coffee cups and napkins to give the participant the impression that the experimenters had forgotten to clean up their lunch from a few days before. While the

experimenter checked their task, the participant could not help but noticing the plate of sandwiches. When the experimenter finished checking their task, the participant went back to his table where he was asked to complete the catering form. In the No Presence condition the participant did not have to come to the table. After some filler tasks, everybody also completed the disgust scale. This scale measured individual differences in disgust sensitivity ($\alpha = 0.72$). It contained 20 relevant items from the disgust scale developed by Haidt et al. (1993). At the end of the experiment, all participants were again invited to complete the contest form to win free sandwiches. In the Presence condition these forms were placed on the table with the sandwiches, while in the No Presence condition this table was empty.

Results

Effect of hunger on variety seeking. Variety seeking was again measured by counting the number of different sandwiches on the contest form. The findings in the no presence condition replicated the results of the first study: Hungry participants ($M_{hungry} = 3.37$) chose significantly more different sandwiches than satiated participants ($M_{satiated} = 2.58$; $F(1, 64) = 5.59$, $p = .02$).

Effect of the presence of stale sandwiches. The major purpose of the second study was to manipulate sandwich attractiveness and to examine its effect on variety seeking tendencies, taking into account disgust sensitivity of the participants. The presence of the sandwiches did not have an effect on the disgust measures ($F(1, 123) = 0.20$, NS). To facilitate the interpretation of our results, we performed a median split on the disgust sensitivity measure. After deleting three outliers, the analysis revealed a marginally significant hunger x presence x disgust sensitivity interaction ($F(1, 108) = 3.70$, $p < .06$).

Insert figure 1 about here

To get more insight in the three-way interaction, we looked at the effect of hunger and presence in the low and high disgust group separately (see fig. 1). In the low disgust group, we found the two expected main effects: Hungry participants chose more variety than satiated participants ($F(1, 108) = 3.02$, $p = .08$) and the presence of the sandwiches increased variety seeking ($F(1, 108) = 11.478$, $p < .001$). The interaction of hunger by presence was not significant ($F(1, 108) = 0.30$, NS). In contrast, in the high disgust group, a two-way

interaction between presence and hunger appeared ($F(1, 108) = 4.50$, $p < .05$). In the No Presence condition, the usual hunger effect was replicated ($F(1, 108) = 7.30$, $p < .01$): Hungry participants ($M_{hungry} = 3.75$) chose more variety than the satiated participants ($M_{satiated} = 2.31$). However, in the Presence condition, the hunger effect disappeared ($M_{hungry} = 2.78$, $M_{satiated} = 2.80$, $F(1, 108) = 0.02$, NS) indicating that the presence of the stale sandwiches was able to block the hunger effect in disgusted people.

To test our hypothesis about the crucial role of food attractiveness, we looked at the effect of the sandwich presence on the ratings of the sandwiches. The same three-way (hunger x presence x disgust sensitivity) analysis of variance was performed on the mean ratings of the sandwiches. These were again measured by the catering form in which the participants were asked to rate, among other food items, eight types of sandwiches. The overall three-way interaction was significant ($F(1, 109) = 4.05$, $p < .05$). Moreover, the means exhibit a similar pattern for the sandwich ratings as for the variety seeking measures (see fig. 2) suggesting a close relationship between attractiveness and variety seeking.

Insert figure 2 about here

For the low disgust sensitive people hunger ($F(1, 109) = 12.57$, $p < 0.001$) as well as presence ($F(1, 109) = 10.89$, $p < .001$) increases the sandwich ratings. As expected, the interaction of hunger by presence was not significant ($F(1, 109) = 0.45$, NS). With high disgust sensitive people, on the contrary, there is a significant interaction between presence and hunger ($F(1, 109) = 4.89$, $p < .05$). Here, we can see clearly that the main effect of hunger on food attractiveness disappears in the Presence condition ($F(1, 109) = 0.37$, NS). In the No Presence condition hunger, again, increases food attractiveness, $F(1, 109) = 5.09$, $p < 0.05$ ($M_{hungry} = 3.33$, $M_{satiated} = 2.65$).

Mediation by attractiveness. As in study 1, we found support for the mediating role of attractiveness in the effect of hunger on variety seeking. When hunger as well as the average sandwich rating are included in the analysis, the hunger x presence x disgust sensitivity interaction reduces ($F(1, 107) = 1.07$, $p = .30$), reducing the mean squares (MS) for this effect by 80%, while the effect of attractiveness on variety seeking is significant ($F(1, 107) = 56.89$, $p < .001$). We may conclude that the underlying fluctuations in food ratings are responsible for changes in variety seeking. To achieve an increase in variety seeking tendencies, an increase in food attractiveness seems necessary. When the latter is inhibited, for example, by

seeing stale food items, hunger does not lead to variety seeking anymore. On the other hand, when the increase in food attractiveness is stimulated, f.e. by using positive food cues, variety seeking may increase even more.

Cognitive depletion hypothesis. As in the first study, we checked whether hunger has a negative effect on our cognitive resources. Therefore, we again created a variable 'preference certainty' to examine its interaction with hunger. The results of the ANOVA analysis are consistent with these of the first study. In the No Presence condition, there is only a main effect of hunger ($F(1, 62) = 7.22$, $p < 0.01$) indicating that participants with low certainty (n = 44) as well as people with high certainty (i.e. clear favorite option) (n = 22) chose more variety when hungry ($M_{low} = 3.33$, $M_{high} = 3.45$) than when satiated ($M_{low} = 2.90$, $M_{high} = 2.00$). That is, in the No Presence condition the interaction which one would expect under the cognitive depletion hypothesis (hunger x preference certainty) is not significant ($F(1, 62) = 2.11$, NS). Inconsistent with the cognitive depletion hypothesis, people with low certainty still seek more variety when hungry than when not hungry.

Discussion

The findings from study 2 corroborate the results of study 1 regarding the facilitating effect of hunger on variety seeking. We also found additional evidence that this effect is mediated by increased food attractiveness. Together, studies 1 and 2 provide robust evidence that changing food ratings have a substantial impact on variety seeking in the same product category. Although in study 1, this effect was driven by hunger, study 2 raised some lingering, though very interesting questions. In study 2, the presence of the sandwiches had a facilitating effect on variety seeking for the low disgust sensitive people, independent of hunger. Indeed, if increasing food ratings appear crucial in mediating the role of hunger on variety seeking, is increasing the attractiveness for food then sufficient to increase variety, even if people are not hungry? We address this question in a third study.

STUDY 3

To investigate whether it is possible to facilitate variety seeking by temporarily increasing the food attitudes of consumers, we used an olfactory food cue, namely the smell of freshly baked cake. In this study, non hungry participants made a choice in a room that was or was not scented with the smell of freshly baked cake. Anyone who has once entered a kitchen where

cake was being baked knows how delectable this smells. Moreover, prior research (Lambert and Neal 1992) has shown that participants, after exposure to an olfactory food cue, reported significantly greater craving, liking, and desire to eat the cued food. Thus, as an olfactory food cue has been shown to be able to increase food attractiveness of the cued food, we expected the cake smell to have a positive influence on variety seeking when choosing between different sorts of cake.

Participants

One hundred and twenty-five undergraduate students (33 men, 92 women) participated in the experiment. They chose to participate in response to sign-up sheets sent to all students of a participant pool. They were paid €7 for their participation. We restricted our analyses to a set of 110 participants: Three persons did not like cake, which may influence the results. Twelve persons reported to have a cold, which may have rendered our smell manipulation ineffective.

Design

The study was designed to assess the impact of an olfactory cue on people's tendency to seek variety. Participants were randomly assigned to the Cue condition or the No Cue condition. In the Cue condition, the smell of baking cake wafted into the laboratory. Both conditions were counterbalanced for time of day to control for naturally occurring hunger effects.

Procedure

Upon entering the laboratory, and after some brief introductory remarks by the experimenter, all participants were seated at a computer in separate cubicles. The experiment was presented as a taste test of self-made cake (which could explain the cake smell present in the laboratory for participants in the Smell condition). First, they completed an introductory form: This form was quite similar to the one used in the first two studies. It consisted of a series of visually analogue scales rating hunger and the frequency of eating cake. The scales were anchored by "not at all" and "extremely" on a 100-mm line. Participants were also asked whether they like cake and whether they had a cold. We measured our main dependent variable, variety seeking, in the beginning of the experiment. In this way, we allowed enough time for the baking smell to affect participants, but not enough time to make them completely adapt to the smell

(Morrin and Ratneshwar 2003). We again measured variety seeking by organizing a contest. This time we gave all participants the chance to win a gift basket with five types of cake, to be home delivered in two weeks. Therefore they had to indicate on a contest form which cakes they would like (butter, chocolate, raisins, nuts, apple, frangipane, fruit, or cappuccino). Afterwards all participants engaged in some other unrelated tasks. At the end of the session we organized the taste test: All participants were asked to taste a piece of cake. Because the taste test had no other use than to provide a context for the study, it was organized at the end of the study. In this way it could not influence the results of the other tasks.

Results

Effect of the olfactory cue on variety seeking. We assessed variety seeking by the number of different cakes participants chose on their contest form. We performed an ANOVA analysis on variety seeking to examine the effect of the olfactory cue. We included the consumption frequency of cake as a covariate. The reason for this is that we can expect that cake smell has a stronger influence on people who eat cake frequently. That is, because these people like cake more than others, they probably like more types of cakes, by which they are able to choose more different cakes.

On the basis of our theoretical discussion, we anticipated that the presence of an olfactory cue would increase variety seeking behavior. The ANOVA analysis confirmed a main effect of smell ($F(1, 104) = 3.94$, $p = .05$). We can conclude that an olfactory cue has a facilitating effect on variety seeking.

Effect of olfactory cue on hunger. The foregoing results showed that a food smell can influence people's variety seeking tendencies. To make sure that hunger did not fully or partially mediate the result, we analyzed the effect of the food smell on hunger. The olfactory cue did not have an effect on the hunger feelings ($F(1, 106) = 0.02$, NS) indicating that hunger cannot explain the increase in variety seeking.

Discussion

The findings from study 3 provide some interesting results concerning the effect of olfactory cues when making multiple food choices. In 1995, Mitchell, Kahn and Knasko did research on a similar theme. They examined the effect of ambient odor on cognitive variables that are

involved in the decision making context. They also investigated the effect of congruent and incongruent smell on variety seeking. They did not find a main effect of smell versus no smell on the number of different chosen options. Here, however, we described a different, complementary approach to this study. That is, while Mitchell et al. (1995) used chocolate and floral scents, we focused on an overwhelming, appetizing smell that is able to increase food attractiveness irrespective of the fact that one is hungry. We found that participants in the Cue condition searched more variety in their choices than people in the No Cue condition which suggests that olfactory cues may facilitate variety seeking. More important, the design of this study enables us to evaluate more definitely the relationship between increasing food attractiveness and variety seeking. In sum, the results of study 3 showed that increasing food attractiveness in itself is sufficient to increase variety seeking. Hunger is only one way to do this; however, one can also use olfactory cues. Our data suggest that all possible means to increase consumers' food attractiveness facilitate variety seeking.

GENERAL DISCUSSION

The main question addressed in this article was whether shopping with an empty stomach could have an influence on consumers' tendency to seek variety. Across three studies, we found a consistent pattern of results. Our first study shows that hunger has a facilitating effect on variety seeking. Moreover, we found that increasing food attitudes play a mediating role in this process. In the second study we found additional evidence for this process. By affecting food attractiveness we were able to examine the role of hunger on variety seeking when an increase in food attitude was blocked by the presentation of stale food. The data showed us that the increase in food attractiveness is a necessary condition for hunger to increase variety seeking in the food domain. Hunger does not increase variety seeking when the presence of stale food blocks the increase in food attitudes that typically follows a hunger state. A last study revealed that increasing food attractiveness, for example by using an olfactory cue, is sufficient to increase variety seeking.

In general, our findings are consistent with the projection bias hypothesis. That is, when consumers are in a non neutral visceral state, for instance hunger, they are impeded to correctly predict their future tastes. Our data indicate that hunger makes food more attractive. We propose that, because of the increase in food ratings, more food items are considered as satisfying which makes it less threatening to divert from the absolute favorites. However, we

have to keep in mind that our results do not fundamentally violate the assumption of a rational decision maker. First, the consumer behaves as a rational person in attempting to maximize her expected utility. However, the problem is that she might fail to do so because she mispredicts her future instantaneous utilities (Loewenstein et al. 2003). Thus, although consumers do not take choices that optimize their future tastes, often this is because they misestimate them, not because they do not want to satisfy them. Secondly, we found that the relative preferences of food items within one category do not change: the global preference order is not influenced by hunger. Indeed, we found that hunger does not make us choose randomly between food items. So, the principle of invariance which is considered as the most essential conditions for rational choice theory (Tversky and Kahneman 1986) is not violated here.

Notwithstanding, although consumers act rationally, this does not imply that the choice made will lead to the best outcome. Based on previous research, we may rather expect the opposite. Read and Loewenstein (1995) introduced the term 'diversification bias' to refer to the excess variety seeking in simultaneous choice. That is, when choosing several items simultaneously, people tend to choose more variety than they really want. The studies described in this article suggest that hunger enhances this bias: When making simultaneous choices, people tend to choose even more variety when hungry than when satiated. In this way, consumers make even worse choices. This means that although a hungry consumer chooses, as a rational actor, more variety, he might regret this choice afterwards and might want to change his mind on the day of consumption.

No evidence was found for the cognitive depletion hypothesis. Our findings indicate that hunger does not deplete our cognitive resources, or at least that the possible depletion does not have important effects on our choice rules. In this framework, it is very important to point out the difference between hunger and naturally occurring fatigue. When a person is tired his central nervous system is less activated than when he/she is not. However, fatigue does not necessarily increases food attractiveness and, thereby, variety seeking. Gibbs and Drolet (2003) even found that higher energy levels do make consumer preferences more ambitious and shift consumption choices toward more challenging products. This implies that we have to distinguish hunger feelings from feelings of fatigue and low energy.

Finally, the results point out the power of hunger and, on a more general level, desire. Although desire has an unmistakable role in consumption decision making, little attention has

been devoted to the role of desire (Belk, Ger, and Askegaard 2003). Our studies provide evidence that, when trying to increase the attractiveness of a product, we do not only have to focus on the product features. We should be aware that we can often increase a product's desirability via the desire of the consumer. Gibbs and Forehand (1997) found in their experiment that desire can be primed. Our results indicate that also hunger, as a 'natural desire' state can offer a possible means to increase the willingness to purchase a product. Within this framework, it is important however to point out that people do not follow some kind of threshold model when making choices: Our data are not consistent with random choice between options that are above a certain threshold, which is in turn influenced by hunger state. Had that been the case, the consistency between the ratings and the choice (see study 1) should have been lower in the Hunger condition than in the Satiated condition, but there was no difference between the two conditions. Rather, people seem to follow a kind of 'ratio model' in which dominance is represented as a ratio. In this way increasing overall food ratings, f.e. due to our hunger state, reduces the relative advantage of the dominant option which facilitates variety seeking.

Implications and research opportunities

The findings provide some interesting guidelines for managing variety seeking. For new or smaller brands, it can be very useful to encourage exploration. As Feinberg and Kahn (1992) found, increasing consumers' desire for variety is likely to increase the market share of the least preferred brand and decrease the market share of the most preferred one. So, when introducing a new brand, it can be interesting to facilitate variety seeking. According to our results a beneficial strategy for new or smaller brands is to increase the attractiveness for their food category. Our findings propose two ways to do this. First, one could concentrate on the 'hungry' points of time to do promotion, that is, just before noon or in the late afternoon. Second, one could use food cues, visual as well as olfactory, to increase overall food attitudes. In this way, one can create a 'variety seeking' stimulating atmosphere. From the viewpoint of the consumer, however, it might be better not to shop with an empty stomach. As 'hunger makes the best sauce', consumers are likely to buy all kind of delicacies which they may regret later.

Our findings also suggest some interesting avenues for future research. First, our results offer some interesting means to facilitate or decrease variety seeking by modifying food attitudes.

A way to modify attitudes is by predisposing manipulations (Gibbs 1997). That is, in advance of being presented with a choice problem, consumers might be treated in various ways to influence their mental states. For example, give them coffee to make them energetic, prompt them to recall positive life events to make them happy, or show attractive members of the opposite sex to arouse their sexual desires. As Gibbs (1997) stated, different predispositions can lead to different preferences, although preference alternatives and problem presentation remain constant. This is because valuation is a mental state and mental states are likely to affect the valuation of decision outcomes. This brings us unavoidably to other visceral states. Indeed, an important question to be addressed in future research concerns the generality of the finding. It would be interesting to expand our research to other visceral states, like thirst or nicotine deprivation. We expect these states to have the same effect on attractiveness (of beverages, cigarettes…respectively) and therefore on variety seeking. Previous research on sexual arousal reports effects in the same direction: Men, who have a higher sex drive than women, desire and enjoy a broader variety of sexual practices than women (Baumeister, Catenese, and Vohs 2001). But also the relationship between other visceral states like emotions, fatigue, social arousal… and variety seeking during shopping deserve extra attention. These clearly are interesting and important questions for future research.
Further, an interesting question deals with the influence of hunger on anticipated regret. As decision making is influenced by the anticipated regret of the options (Cooke, Meyvis, and Schwartz 2001), consumers may anticipate a higher regret from assortments with high variety. This anticipated regret may even influence store choice (van Herpen 2001). However, it is possible that hunger influences this ability to anticipate. By offering too much variety, a retailer might tempt hungry or otherwise desiring consumers to choose a lot of unwanted products, which might eventually backfire if the consumer learns from this experience.
Other remaining questions to be addressed in future research concern the whether hunger also makes consumers deviate from their favorite snack when they can only make one choice, and become more responsive to lesser known or newly introduced brands. As we found that hungry consumers like the same sandwiches the best, we expect that this is not the case. On the other hand, because the consideration set becomes larger, less dominant options might enter, and hence, be chosen sometimes. It would also be interesting to examine whether hunger can influence our choice behavior in the long term. Kahneman and Snell (1992) found that people do make allowances for changes in their hedonic ratings when predicting tastes for a longer time-horizon. When we keep this in mind, it is possible that hunger can influence our

choice behavior for the near future but not for the more distant future, like next month or next year.

Appendix

Consistency measure: $$\zeta = 1 - \frac{\sum \Delta\text{obs} - \sum \Delta\text{min}}{\sum \Delta\text{max} - \sum \Delta\text{min}}$$

Hereby, Δobs is the observed quantity choice minus the theoretically best quantity choice; Δmin is the practically best quantity choice minus the theoretically best quantity choice; Δmax is the worst quantity choice minus the theoretically best quantity choice. This index refers to the difference, summed over the choice set options, between one's actual choice pattern and the worst possible choice, compared to the difference between the most and least consistent possible choice. The worst quantity choice pattern is the most discrepant behavior a person could make given his food ratings. In general, this means that one chooses five times the sandwich he/she has rated worst. The most consistent possible choice refers to the optimal choice given a certain choice rule (different choice rules lead to different most consistent possible choices). Clearly, it is not always possible for a consumer to behave theoretically optimally, because our participants had to make integer choices although the choice rule may have implied to choose a decimal quantity (e.g. 0.66) of a sandwich. We subtracted ∑(Δmin) in the numerator as well as in the divisor to ensure that the quantity, ζ ranges between zero and one.

Example

sandwich ratings:	
cheese	*4*
ham	*3*
crab	*5*
salmon	*4*
tuna	*3*
potato	*5*
bacon	*3*
mozzarella	*5*

choice behavior:	
cheese	*1*
ham	*0*
crab	*1*
salmon	*1*
tuna	*0*
potato	*1*
bacon	*0*
mozzarella	*1*

	Theoretically best		***Practically best choice***		***Worst***
	DOM	***PROP***	***DOM***	***PROP***	
Cheese	*0*	*0,625*	*0*	*1*	*0*
Ham	*0*	*0,469*	*0*	*0*	*5*
Crab	*1,67*	*0,781*	*2*	*1*	*0*
Salmon	*0*	*0,625*	*0*	*1*	*0*
Tuna	*0*	*0,469*	*0*	*0*	*0*
Potato	*1,67*	*0,781*	*2*	*1*	*0*
bacon	*0*	*0,469*	*0*	*0*	*0*
mozzarella	*1,67*	*0,781*	*1*	*1*	*0*

- *Consistency with a dominance-based choice behavior:* ***0,926***

  $\Sigma(\Delta obs) = (1-0)^2 + (0-0)^2 + (1-1,67)^2 + (1-0)^2 + (0-0)^2 + (1-1,67)^2 + (0-0)^2 + (1-1,67)^2$

  $\Sigma(\Delta min) = (0-0)^2 + (0-0)^2 + (2-1,67)^2 + (0-0)^2 + (0-0)^2 + (2-1,67)^2 + (0-0)^2 + (1-1,67)^2$

  $\Sigma(\Delta max) = (0-0)^2 + (5-0)^2 + (0-1,67)^2 + (0-0)^2 + (0-0)^2 + (0-1,67)^2 + (0-0)^2 + (0-1,67)^2$

- *Consistency with a proportion-based choice behavior:* ***1***

  $\Sigma(\Delta obs) = (1-0,625)^2 + (0-0,469)^2 + (1-0,781)^2 + (1-0,625)^2 + (0-0,469)^2 + (1-0,781)^2 + (0-0,469)^2 + (1-0,781)^2$

  $\Sigma(\Delta min) = (1-0,625)^2 + (0-0,469)^2 + (1-0,781)^2 + (1-0,625)^2 + (0-0,469)^2 + (1-0,781)^2 + (0-0,469)^2 + (1-0,781)^2$

  $\Sigma(\Delta max) = (0-0,625)^2 + (5-0,469)^2 + (0-0,781)^2 + (0-0,625)^2 + (0-0,469)^2 + (0-0,781)^2 + (0-0,469)^2 + (0-0,781)^2$

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FIGURE 1

HUNGER X PRESENCE X DISGUST SENSITIVITY INTERACTION ON VARIETY SEEKING (STUDY 2)

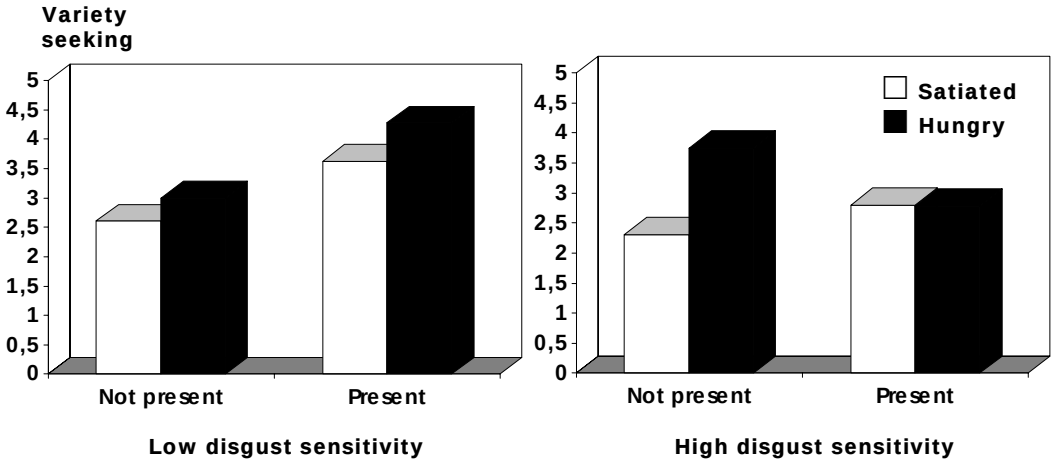

FIGURE 2

HUNGER X PRESENCE X DISGUST SENSITIVITY INTERACTION ON SANDWICHES RATINGS (STUDY 2)